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Voluntary Environmental Disclosures in 10-Ks and Environmental Reports: Determinants and Relationship to Firm Risk Premium

Abstract

We investigate the effect of corporate environmental performance, measured as Toxics Release Inventory and CO2 equivalent emissions on the levels of environmental disclosure in both Forms 10-K and standalone Sustainability or Environmental Reports (CERs). We then evaluate the association between environmental disclosure levels and estimated firm risk premium. Our sample consists of firms in the chemical and electric utilities industry, publicly traded in U.S. markets, and covers the years 2005 – 2009. Our results suggest that companies with higher emissions have higher levels of environmental disclosure in Forms 10-K and lower levels of disclosure in CERs. Controlling for environmental performance, there is a positive association between the levels of disclosure in Forms 10-K and CERs. Disclosure level for both reporting types is positively associated with public scrutiny, measured as shareholder resolutions relating to environmental disclosures. The association between firm risk premium and disclosure levels in both types of reports is significantly positive for our sample of chemical companies and insignificant for our sample of firms in the electric utilities industry.

Keywords: environmental disclosure, environmental performance, cost of equity capital

I. INTRODUCTION

This study evaluates the role of environmental performance and public scrutiny on firm voluntary environmental disclosure choice and the resulting effect of such disclosures on firm risk premium. The questions of why firms engage in voluntary disclosure and the firm cost of capital effects were raised by Healy and Palepu (2001). We address these questions in the context of voluntary environmental disclosures in the environmental section of Corporate Sustainability Reports or stand-alone Corporate Environmental Reports (CERs) and in 10-K or Annual reports (10-K). We model management's decision to disclose in these two types of reports as a function of private information regarding environmental performance as well as demand for disclosure through shareholder resolutions. When voluntary and mandatory disclosures are made public, we analyze the effect of the voluntary disclosures, environmental performance disclosures and public scrutiny on firm risk premium.

Our study builds upon and extends current research in the area of voluntary environmental disclosures. Unlike prior studies which evaluate the effect of environmental performance on CER disclosure alone (Clarkson et al. 2008, 2011; Connors and Silva-Gao 2011), or on 10-K disclosures (Cho and Patten 2007; Ingram and Frazier 1980; Wiseman 1982; Patten 2002), or on a blend of both (Plumlee et al. 2008), we explicitly test whether the association between environmental performance and disclosure in each type of report is distinct. The motives of management for providing voluntary disclosures in each type of report may be different, and investors, in turn, may view the value of disclosures differently depending on the reporting mode.

We also evaluate the effect of shareholder resolutions on disclosure choice. While size is often considered to be a proxy for public scrutiny in disclosure literature, it does not specifically capture the effects of stakeholder pressure to improve particular types of voluntary disclosures. We measure the effects of shareholder resolutions relating to environmental performance disclosure in order to capture the "demands of a broader group of stakeholders" (Moser and Martin 2012) which may conflict with the interests of some investors (Bénabou and Tirole 2010). Shareholder resolutions relating to environmental performance and disclosure are often proposed by non-government organizations (NGOs) such as environmental and/or religious groups with minimal share ownership (O'Rourke 2003; Byrd and Cooperman 2012).

Finally, we examine the effect of firm voluntary environmental disclosures on firm risk premium in the period in which both the firm's disclosures and third-party environmental performance disclosures are made public. Our model assumes that a manager knows her firm's environmental performance in any given time period and determines the extent and timing of environmental disclosures to coincide with third-party environmental performance data release to the public in the subsequent time period, depending on the year in question.

Our study includes two measures of environmental performance, namely Toxics Release Inventory (TRI) and CO2 equivalent (CO2e) emissions. This greatly expands the measure of environmental performance from previous studies that have used TRI as a single measure (Clarkson et al. 2004, 2008; King and Lenox 2001, 2002; Konar and Cohen 1997). The measures also allow us to avoid the use of social ratings, such as those developed by Kinder, Lydenberg, Domini Research and Analytics (KLD) and

increasingly used in research on environmental performance and disclosure (Dhaliwal et al. 2011). The KLD ratings have been criticized for lack of predictive ability (Chatterji et al. 2009; Sharfman 1996) and are not an appropriate measure for our study. It is unlikely that the KLD ratings affect management disclosure choice due to a lack of transparency (Chatterji and Levine 2006) and timeliness. We focus on publicly traded U.S. companies in two highly polluting industries, electric utilities and chemicals, in order to minimize the possible influence of end consumer preferences and to increase the power of our tests and the clarity of our results. Our data covers disclosure years 2005 - 2009. Although this time period is not of sufficient length to conduct meaningful trend analysis, it does reduce the potential bias of evaluating a single year.

The results of our study show that our sample companies with high emissions provide more voluntary disclosure in their 10-Ks and less in their CERs than companies with low emissions. Our regression results indicate that the extent of voluntary 10-K and CER disclosures is positively correlated when controlling for environmental performance. Firms that are the target of shareholder resolutions relating to disclosure provide more voluntary environmental information in both 10-Ks and CERs, depending on which report is the focus of the resolution. In addition, companies in the chemical industry that provide more extensive disclosure in both types of reports have a higher risk premium than those that do not. Our results do not show a significant association between disclosure and risk premium in the electric industry. Public scrutiny is associated with higher firm risk premium in both industries.

Recently, considerable attention has been given to attempts to determine which environmental, social and governance (ESG) metrics matter to a broad variety of

corporate stakeholders and whether those disclosures should be standardized and mandated (Hespendheide and Koehler 2012; Soyka and Bateman 2012). The International Integrated Reporting Council (IIRC) has been a strong advocate for firms to produce "integrated reports" which show how strategy, governance and performance contribute to firm value (IIRC, 2012). Several public accounting firms and research groups have given support to the integrated reporting framework (Deloitte 2012; KPMG 2012; PwC 2012; UBS Investment Research 2012; Initiative for Responsible Investment 2010). One of the important steps in this process requires determining which measures of non-financial performance are valued by stakeholders (IIRC, 2012). As an initial step in this process, the results of our study provide insight into the relationship between a subset of environmental performance measures and shareholder assessment of firm risk in two important U.S. industry sectors. Further, our study extends current disclosure literature by introducing a self-constructed measure of 10-K environmental disclosures that is relatively detailed and complete for the sample industries. Analyses based on this measure, as well as the detailed Clarkson et al. (2008) measure of disclosure in CERs, provide a fuller representation of disclosure choice and practices than has been presented in previous studies.

The remainder of this paper is presented as follows: Section II discusses the related research and develops hypotheses. Section III describes the sample and the methodology of the study. Section IV presents the descriptive statistics and empirical results and Section V presents a summary and conclusions.

II. Related Research and Hypothesis Development

Several studies have studied the precursors to, or effects of, voluntary environmental disclosures in CERs (Clarkson et al. 2008, 2011; Connors and Silva-Gao 2011) and in 10-K/Annual Reports (Blacconiere and Patten 1994; Cho and Patten 2007; Ingram and Frazier 1980; Patten 2002; Barth et al. 1997; Wiseman 1982), or do not distinguish between disclosures in CERs and 10-K/Annual Reports (Plumlee et al. 2008). We argue that the level of disclosures in CERs and 10-K/Annual Reports are jointly determined, endogenous choice variables and are a function of related, but distinctly separate processes. While there is no disclosure theory to support the notion that firms use these two reporting avenues as substitutes or compliments, it is unlikely that firms make the disclosure decisions relating to them in isolation.

H1: Voluntary environmental disclosures in CERs and in 10-Ks are jointly determined, endogenous choice variables.

There are costs and benefits associated with corporate disclosure. Dye (1985) and Verrecchia (1983) develop models which show that managers will withhold proprietary information if it is expected that its disclosure would provide competitive advantage to competitors or draw scrutiny of regulators or other interested third parties. Managers may also withhold information if it is believed that investors and other stakeholders can find it from other sources at lower cost. Alternatively, managers have incentives to disclose good performance information in order to reveal their performance type and to differentiate their firms from those with poor performance (Dye 1985; Verrecchia 1983). One of the difficulties facing environmental disclosure researchers is determining the definition of "good" environmental performance for the signal and making sure that the measure of performance, the message service (Hirshleifer and Riley 1992), is appropriate.

Empirical studies do not show a clear relationship between firm environmental performance and voluntary disclosure. Clarkson et al. (2008) found that good environmental performance in the form of lower TRI emissions is associated with more extensive environmental disclosure in CERs. Al-Tuwaijri et al. (2004) modeled environmental performance, financial performance, and environmental disclosure as jointly determined by firm strategy and also found that environmental performance is positively associated with environmental disclosure. However, Delmas and Blass (2010) found the opposite results in a small sample study. Bewley and Li (2000) found that poor environmental performers disclosed more voluntary environmental information in their Annual Reports, and neither Wiseman (1982) or Freedman and Wasley (1990) found a statistically significant relationship between disclosure and performance.

Our study evaluates the decision to report environmental information in both CERs and 10-Ks. The motivations for doing so may differ between firms. For example, firms may choose to provide little voluntary information in financial statements given potential litigation and audit costs and shift environmental disclosures to CERs. Alternatively, firms may determine that providing environmental reports to the public is costly and choose to limit their environmental disclosures to those provided in 10-Ks. Given this complexity and the inconclusive results of previous studies, we propose the following non-directional hypothesis:

H2: Voluntary environmental disclosure is associated with environmental performance.

Environmental activists often target larger and highly visible firms because they are more likely to result in media and public attention (Lenox and Eesley 2009). In addition, Reid and Toffel (2009) found that firms that are targeted by shareholder actions

on the environment are more likely to voluntarily disclose environmental information to the Carbon Disclosure Project, a third party reporting agency. Therefore, we expect that the firms in our sample that are targeted by shareholder resolutions in any particular year will have higher voluntary environmental disclosures.

H3: Voluntary environmental disclosures are positively associated with shareholder resolutions.

Botoson and Plumlee (2002) found that cost of equity capital is positively associated with the level of financial disclosure in annual reports, but negatively associated with the level of disclosure in quarterly reports. Botoson (1997) found that the relationship between annual report disclosure level and the cost of equity capital is conditional on analyst following, with only firms with a low analyst following receiving a lower cost of capital benefit from greater disclosure.

Dhaliwal et al. (2011) focused on the decision to issue CERs for the first time and did not measure the extent or levels of disclosure within those reports. They found that firms with a high cost of equity capital were more likely to issue first time CERs and were subsequently rewarded with a lower cost of equity capital. The authors argued that CER reporting is a mechanism for firms to signal superior corporate social performance. This result may not hold in all cases. For example Marquis and Toffel (2011) documented extensive selective environmental disclosure across a very large sample of corporations in 46 nations. Their results suggest that firms do not always fully report environmental performance. This sort of "greenwashing" may lead analysts and investors to discount or ignore environmental disclosures in either CERs or 10-Ks, or both. Therefore, we propose a non-directional hypothesis regarding the relationship between voluntary environmental disclosures and the cost of equity capital/risk premium.

H4: Firm risk premium is associated with voluntary environmental disclosures.

III. SAMPLE AND METHODOLOGY

Sample Description

The sample in our study is taken from publicly traded U.S. firms in the electric utility and chemical industries. While this sample choice limits the ability to generalize from the results, it allows us to collect extensive data on toxic chemical emissions through the Environmental Protection Agency (EPA). The two industries have some of the highest levels of chemical and carbon emissions in the U.S. and include a relatively large number of firms. We study the voluntary environmental reporting of the sample firms for the period 2005 - 2009. This time period was limited by the availability of data on CO2e emissions.

Specifically, we employ a sample of 35 chemical (SIC 28) companies and 39 electric utilities (SIC 49) for which we have sufficient TRI (six years), CO2e (five years), 10-K/Annual Report, CRSP, Compustat, and I/B/E/S data, for a total of 171 and 193 firm-year observations, respectively. We use two measures of firm environmental performance. The first is pounds of annual TRI emissions. The EPA requires companies in these two industries to report these data annually to the administration, at the plant level. The EPA then makes the plant level data available to the public for all plants in the U.S. at the same time. We aggregated these data to the parent level on a company-by-company and year-by-year basis in order to assure accuracy of the parent company data.[1]

[1] The EPA cautions that its parent company data for this time period is often inaccurate and incomplete. We assigned all of the plants in the TRI database in each SIC code to their parent companies and subsequently followed plant closures, sales, and acquisitions to update the data annually. This was the method employed by the Investor Responsibility Resource Center and currently is the method used by Abt Associates, an environmental research and consulting group.

The second measure of environmental performance is the emissions of CO2e which we collected from a database maintained by Trucost. Trucost collects its data on emissions directly from company management and from publicly available sources, when available. If these avenues are not sufficient, Trucost uses a proprietary input-output model to calculate emissions on nine greenhouse gases and converts the emissions to CO2e based on Global Warming Potential factors published by the Intergovernmental Panel on Climate Change (Trucost 2009, p. 35).

In order to quantify the voluntary disclosures in CERs we employ the index proposed by Clarkson et al. (2008). The index is based on the Global Reporting Initiative (GRI) Sustainability Guidelines of 2002. The disclosure index includes 95 items of which 35 are "yes"/"no" indicators. The remaining 60 items score disclosure of ten environmental performance indicators on a scale of 0-6. We employed a method similar to Clarkson et al. (2008) for assigning points to this scale. We assigned two points for disclosure of actual emissions and 1 point each for disclosure of conservation and recycling results, company historic trends, company emissions targets, and comparative industry averages.

We constructed an environmental disclosure content analysis index for 10-K/Annual Reports by examining a number of reports for companies in the electrics and chemical industries and developing a scoring model that included all of the environmental disclosures and categories presented in the reports during our sample period. This method of building an index potentially limits its usefulness in studies of other industries. For example, companies in the retail industry are unlikely to be involved in environmental litigation or have direct environmental compliance or

remediation costs. Nevertheless, the index is applicable to the industries of interest in this study and eliminates the need to score on an index that includes extraneous or irrelevant items. Consistent with the Clarkson et al. (2008) index, no attempt was made to determine whether the disclosures convey "good" or "bad" news.

Models and Variable Definitions

To test H1 – H3, we model firm voluntary environmental disclosures in CERs and 10-Ks as endogenous and jointly determined. Furthermore, we assume that managers make decisions regarding environmental disclosures in reports that will be released to the public in fiscal year *t* during fiscal year *t-1* based on knowledge of the firm's estimated TRI and CO2e emissions and proposed shareholder resolutions for the year. Our model is specified as the following set of linear structural equations:

$$\begin{aligned} CERDisc_{it} = {} & \alpha_1 + \beta_{11}\, 10KDisc_{i,t} + \beta_{12}\, EMITfs1_{i,t-1} + \beta_{13}\, EMITfs2_{i,t-1} \\ & + \beta_{14}\, SHResESR_{i,t-1} + \beta_{15}\, LevAssets_{i,t-1} \\ & + \beta_{16}\, lnMVE_{i,t-1} + \beta_{17}\, ROA_{i,t-1} + \beta_{18}\, BWpdiff_{i,t} + \beta_{19}\, IndustDV_{i,t} \\ & + \varepsilon_{1i,t} \end{aligned} \quad (1)$$

$$\begin{aligned} 10KDisc_{it} = {} & \alpha_2 + \beta_{21}\, CERDisc_{i,t} + \beta_{22}\, EMITfs1_{i,t-1} + \beta_{23}\, EMITfs2_{i,t-1} \\ & + \beta_{24}\, SHRes10K_{i,t-1} + \beta_{25}\, LevAssets_{i,t-1} \\ & + \beta_{26}\, AbnAccr_{i,t-1} + \beta_{27}\, lnMVE_{i,t-1} + \beta_{28}\, ROA_{i,t-1} \\ & + \beta_{28}\, BWpdiff_{i,t} + \beta_{29}\, IndustDV_{i,t} + \varepsilon_{2i,t} \end{aligned} \quad (2)$$

All of the variables in equations (1) and (2) are defined in Exhibit 1 (*i* indexes firms and *t* indexes years).

In equation (1), *CERDisc* is the total score from the Clarkson et al. (2008) index as applied to CERs for our sample firms. (Firm-year observations without CERs are scored at zero.) The variable *10KDisc* is the total score from the 10-K/Annual Report index, and *SHResESR* represents the total number of shareholder resolutions requesting improved environmental disclosure in CERs filed against each firm. Data regarding

shareholder resolutions was obtained from the Interfaith Center on Corporate Responsibility (ICCR) which maintains a database of all social justice resolutions filed by their members as well as non-members. The ICCR coordinates shareholder resolutions and the tracking of resolutions with Ceres, a leading sustainability organization in the U.S.

The variables *EMITfs1* and *EMITfs2* are maximum likelihood estimation (MLE) factor scores resulting from linear combinations of TRI emissions scaled by U.S. sales in five categories (air, water, land, underground injection, and off-site transfers) and tons of CO2e emissions scaled by global sales. We include four control variables in equation (1). *LevAssets* is a measure of leverage, the ratio of total debt to total assets. *lnMVE* is a proxy for firm size defined as the natural logarithm of the market value of common equity. *ROA* is a measure of return-on-assets. *IndustDV* is an indicator variable that equals 1 if the firm is an electric utility and 0 otherwise.

Equation (2) includes the explanatory variable *SHRes10K* which represents the total number of shareholder resolutions filed requesting improved environmental disclosure in 10-K reports for each firm. This equation also includes a control variable *AbnAccr* which is the absolute value of estimated abnormal or discretionary accruals for each firm (Dechow et al. 1995). This variable controls for the possibility that a firm's level of reporting regarding environmental performance is simply an extension of the firm's relatively good or poor quality financial reporting in its 10-K and annual reports.

The following linear equation contains our model of the determinants of a firm's cost of equity capital or risk premium and provides a test of H4:

$$BWpdiff_{i,t} = \alpha_3 + \beta_{31}\, 10KDisc_{i,t} + \beta_{32}\, CERDisc_{i,t} + \beta_{33}\, EMITfs1_{i,t-1} + \beta_{34}\, EMITfs2_{i,t-1} + \beta_{35}\, SHRes10K_{i,t} + \beta_{36}\, LevMVE_{i,t} + \beta_{37}\, UBeta_{i,t} + \beta_{38}\, LTGrowth_{i,t} + \beta_{39}\, SDfeps_{i,t} + \beta_{3,10}\, lnMVE_{i,t} + \beta_{3,11}\, IndustDV_{i,t} + \varepsilon_{3i,t} \quad (3)$$

BWpdiff is an estimate of firm risk premium introduced in Baginski and Wahlen (2003). They argued that, as long as forecasted earnings per share, book values and dividends follow clean surplus accounting, the residual income valuation model is equivalent to the dividend valuation model and a firm's observed stock price in period *t* may be conceptualized as:

$$P_{it} = B_{it} + \Sigma^{\infty}_{s=1}\, E_{it}[\, eps_{i,t+s} - r\, B_{i,t+s-1}] / (1+r)^s$$

where:

P_{it} = firm *i*'s stock price at the end of its fiscal year *t*,
B_{it} = firm *i*'s book value per share at the end of its fiscal year *t*,
$eps_{i,t+s}$ = firm *i*'s earnings per share at the end of its fiscal year *t*+s, s ≥ 1,
r = firm *i*'s discount rate, and
$E_{it}[\ ]$ = the expectations operator as of period *t*.

To estimate a risk-free share price value, RFV_{it}, for each firm *i* in period *t*, which can then be compared to the observed share price, Baginski and Wahlen (2003) compute:

$$RFV_{it} = B_{it} + \Sigma^{4}_{s=1}\, E_{it}[\, eps_{i,t+s} - r_{rf}\, B_{i,t+s-1}] / (1+ r_{rf})^s + E_{it}[\, eps_{i,t+5} - r_{rf}\, B_{i,t+4}] / (r_{rf} - g)(1+ r_{rf})^4$$

where r_{rf} is the risk-free discount rate and g is the long-run nominal growth rate in abnormal earnings common to all firms.

We operationalize the expected $eps_{i,t+s}$ with $feps_{i,t+s}$, the mean of all analyst forecasts of earnings per share for firm *i* for fiscal year *t*+*s*, available at the end of each firm *i*'s fiscal year *t*, from I/B/E/S International, Inc., Detail History, Detail. For the risk-

free rates, we employ Daily Treasury Yield Curve Rates on ten-year U.S. Treasury bills.[2] Following Baginski and Whalen (2003), we compute expected book values per share as:

$$B_{i,t+s} = (1 - DivPayout_{it})\, B_{i,t+s-1}$$

where the dividend payout ratio, $DivPayout_{it}$, for firm i for period t and all periods $t+s$ equals dividends per share divided by earnings per share during period t (dividends per share are computed as dividends on common/ordinary stock divided by common shares outstanding used to compute EPS Basic, all divided by EPS Basic excluding extraordinary items). Finally, following Baginski and Wahlen (2003) and others, we assume that g, the long-run nominal growth rate in abnormal earnings beyond year $t+5$, equals three percent. In order to capture the reduction in the firm's stock price due to risk we calculate:

$$BWpdiff_{it} = P_{it} - RFV_{it}$$

10KDisc and *CERDisc* are the dependent variables in equations (1) and (2) above. *EMITfs1* and *EMITfs2* are MLE factor scores representing environmental performance from the prior year. It is important to note that the underlying emissions data are not provided to the public by the EPA or Trucost until the current year. Therefore, these variables represent the most current public information regarding these emissions types.

Equation (3) includes six control variables of which four have not previously been defined. (These variables are also defined in Exhibit 1.) *LevMVE* is a market-oriented measure of leverage, the ratio of debt to the market value of common equity. Cost of equity capital is expected to be increasing in the degree of leverage (Fama and French

[2] See www.treasury.gov/resource-center/data-chart-center/interestratestatistics.

1992). *UBeta* is the unlevered firm beta, a measure if firm-specific risk (Botosan and Plumlee 2005). Following Botosan and Plumlee (2005), we measure $UBeta_{it}$ as:

$$UBeta_{it} = MktBeta_{it} / (1 + LTDebt_{it} / MVE_{it})$$

where *LTDebt* is long-term debt and MVE_{it} is the market value of common equity.

LTGrowth is the expected long-term growth in earnings as measured by the percentage change in analyst forecasts of earnings per share from period *t+2* to period *t+3* (Botosan and Plumlee 2005). *SDfeps* is a measure of information risk, estimated as the standard deviation of analysts' forecasts of earnings per share for period *t+1*.

IV. RESULTS

Descriptive Statistics

Table 1 provides descriptive statistics by industry and in total for measures of firm size and other variables utilized in our analyses. The average global sales revenues of the chemical and electric utility companies in our sample are very similar at $7,538 million and $8,124 million respectively. On average, our sample electric utilities have higher total assets, lower return on assets, higher leverage, and lower beta and unlevered beta than our sample companies in the chemical industry. The electric utilities in our sample also have a lower mean Baginski and Whalen (2003) estimated risk premium.

We analyze the mean differences of emissions by industry in Table 2. On average, our sample of electric utilities have larger TRI emissions to air (t-stat.=-4.04, $p<0.0001$) and to land (t-stat.=-9.50, $p<0.0001$) and have higher CO2e emissions (t-stat.=-20.01, $p<0.0001$). Our sample of chemical companies have higher emissions to water (t-stat.=7.45, $p<0.0001$) and to underground injection (t-stat.=5.44, $p<0.0001$). Overall, though, the difference in total TRI emissions between industries is not significant.

Table 3 provides detail regarding the number and percentage of our sample firms that provide CERs to the public. There has been a trend toward a greater number of firms reporting. In 2005 a smaller percentage of the chemical companies provided CERs than of the electric utilities, but by 2009 more than 55 percent of the chemical companies provided CERs as opposed to 45 percent of the electric utilities. This suggests that, during our sample period, chemical company managers, for some reason, grew to find the publication of CERs somehow more beneficial.

The analysis in Table 4 presents results similar to Clarkson et al. (2008) and provides evidence that the information contained within the reports is not extensive. Of the hard disclosures[3], our reporting firms provided information regarding the existence of an environmental management department in 23% of the reports and almost never discussed independent verification or assurance of the information in the reports. The reporting companies most often provided some information regarding greenhouse gas emissions (1.11 on a scale of 0-6) followed by information on other air emissions, waste generation, and compliance performance. Of the soft disclosures, the reports contained a CEO statement on environmental performance 30.1% of the time and discussed employee training in environmental management 41.6% of the time.

There are significant differences in CER disclosure categories between industries. While the results in Table 3 indicate that the sample chemical companies produced more CERs, the results in Table 5 suggest that, in terms of disclosure content, the sample electric utilities disclosed more in five of the seven categories in Clarkson et al. (2008) index. They show that our sample electric utilities present more information on items

[3] Clarkson et al. (2008) classify the items in their scoring model as either "hard" or "soft" disclosure measures. Hard disclosures are considered to be more objective than soft disclosures.

that relate to credibility or outside verification of environmental programs and initiatives (t-stat.=-4.46, p<.0001), environmental spending (t-stat.=-2.50, p<0.10), vision and strategy (t-stat.=-2.71, p<0.01), environmental profile (t-stat.=-6.09, p<0.0001) and environmental initiatives (t-stat.=-3.17, p<0.01) than our sample chemical companies. Overall, though, the difference between total disclosure scores within the two industries is not significant. That is largely due to the fact that the A3 category is coded on a scale of 0-6, giving it a heavy weight. The difference between industries on A3, environmental performance indicators, however, is not significant.

Our review and coding of environmental disclosure in 10-Ks and, in a few instances, Annual Reports has shown that most disclosures can be found in the footnotes to the financial statements, usually under the heading "Environmental Matters". The "Risk Factors", "Legal Proceedings" and "Management's Discussion and Analysis" sections of the reports were also reviewed. These sections normally reflect the information in the footnotes and often direct the reader to the footnotes for full details and explanation. It appears that the environmental disclosures in these reports are largely voluntary. Disclosure related to D1. "Litigation" is likely motivated by compliance with SFAS 5, Accounting for Contingencies. Nevertheless, the footnote disclosure rules under this Statement allow substantial management discretion and non-conservative reporting. We also documented few, if any, disclosures for which Item 103 of Regulation S-K applied.[4] In all of the other categories, the dollar amounts of disclosures that we observed were far below conventional materiality levels.

[4] Specifically, Instruction 5 to Item 103 states:

> "Notwithstanding the foregoing, an administrative or judicial proceeding (including, for purposes of A and B of this Instruction, proceedings which present in large degree the same

Table 6 provides the percentages of firm-year 10-K environmental disclosures. The disclosures of our sample electric utilities reflect the fact that most of their emissions are to the air on our measures of TRI and CO2e. The percentage of reports that discuss litigation relating to the Clean Air Act (60.1%) or relating to carbon dioxide (20.2%) are much higher than the reports of our sample chemical companies which tend to report litigation relating to other types of environmental damage (47.7%). The electric company reports were also more likely to discuss management strategies relating to air (23.8%) or greenhouse gases (31.6%) than chemical company reports. The analysis reported in Table 7 shows that our sample of electric utility companies provided more environmental disclosures than the chemical companies in all categories except D2. "Dollars spent on penalties and fines" and D4. "Regulatory compliance and remediation costs" in which there are no statistically significant differences in reporting. Consistent with the Clarkson et al. (2008) scoring model, we have further classified our categories as either hard

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> issues) arising under any Federal, State or local provisions that have been enacted or adopted regulating the discharge of materials into the environment or primary for the purpose of protecting the environment shall not be deemed "ordinary routine litigation incidental to the business" and shall be described if:

(A) Such proceeding is material to the business or financial condition of the registrant;

(B) Such proceeding involves primarily a claim for damages, or involves potential monetary sanctions, capital expenditures, deferred charges or charges to income and the amount involved, exclusive of interest and costs, exceeds 10 percent of the current assets of the registrant and its subsidiaries on a consolidated basis; or

(C) A governmental authority is a party to such proceeding and such proceeding involves potential monetary sanctions, unless the registrant reasonably believes that such proceeding will result in no monetary sanctions, or in monetary sanctions, exclusive of interest and costs, of less than $100,000; provided, however, that such proceedings which are similar in nature may be grouped and described generically." http://www.sec.gov/rules/interp/2010/33-9106.pdf.

disclosures or soft disclosures. We consider categories D1 through D6 to be hard disclosures because they tend to be more objective and verifiable than those in category D7, which we consider to be comprised of soft disclosures. Our sample electric utilities provide more disclosures than chemical companies on both hard and soft disclosures.

Empirical Results Relating to Disclosure

H1 predicts that voluntary environmental disclosures in 10-Ks and CERs, as modeled in equations (1) and (2), are endogenous and jointly determined by firm management. A Hausman (1978) test rejects the null hypothesis of no endogeneity ($F_{(1, 328)} = 2282.43$, $p<0.0000$), supporting H1. Also, from an econometric perspective, using ordinary least squares (OLS) to estimate the coefficients in equations (1) and (2) may result in inconsistent coefficient estimates. Therefore, we have employed two-stage least squares (2SLS) to estimate the coefficients.[5]

Table 8 provides the results of our 2SLS regression analyses. Column (1) presents the results for equation (1), and Column (2) presents the results for equation (2). In equation (1), there is a positive correlation between *CERDisc* and *10KDisc* (z-stat.=3.91, $p<0.0000$) as predicted. In equation (2), there is a positive correlation between *10KDisc* and *CERDisc* (z-stat.=4.48, $p<0.0000$). These results also lend support to H1. Because both signs are positive, these results may also suggest that managers may consider CER and 10-K disclosures to be complements, as opposed to substitutes; that is, managers who

[5] Further, when panel data are employed and errors are serially and/or contemporaneously correlated, OLS variance-covariance matrix estimators can be biased downward (Wooldridge 2002). As a result, OLS t-statistics can be biased upward. The errors may also be heteroscedastic. Breusch-Pagan (1979)/Cook-Weisberg (1983) χ^2 test statistics reject homoscedasticity. Therefore, we have estimated the variance-covariance matrices for equations (1), (2) and (3) in a manner which simultaneously clusters observations by firm (Wooldridge 2002) and adjusts for heteroscedasticity (White, 1980).

consider disclosures in one of the two forms to be beneficial may also find disclosures in the other form to be beneficial.

The results in Table 8 show negative correlations between *CERDisc* and *EMITfs1* (z-stat.=-2.36, $p<0.05$) and *EMITfs2* (z-stat.=-1.89, $p<0.10$), indicating that firms with *lower* TRI and CO2e emissions disclose more in CERs than firms with higher levels of pollution. This result supports H2. These results are consistent with those of Clarkson et al. (2008), who hypothesized the good environmental performers disclose more in order to signal their performance type and thereby to achieve a competitive advantage. These results are also consistent with those of Al-Tuwaijri et al. (2004). In contrast, the results for equation (2) indicate that firms with *higher* levels of emissions voluntarily disclose more in their 10-Ks, as evidenced by the significant and positive coefficients on *EMITfs1* (z-stat.=1.82, $p<0.05$) and *EMITfs2* (z-stat.=1.62, $p<0.10$). These results suggest that managers take different factors into account in determining CER and 10-K environmental disclosures. For example, compliance with SFAS 5 and concerns regarding litigation may influence 10-K disclosure decisions more than CER disclosure decisions.

H3 is also supported. Shareholder resolutions requesting greater disclosure in CERs are positively associated with CER disclosure as shown by the coefficient on *SHResCER* (z-stat.=2.02, $p<.05$) in column (1). Shareholder resolutions requesting improved disclosure in 10-Ks are positively associated with 10-K disclosure as evidenced by the coefficient on *SHRes10K* (z-stat.=3.71, $p<0.001$).

Among the remaining variables in equation (2), it is interesting to note that the coefficient estimate for *AbnAccr* is not significant, which is consistent with there not being a relationship between the sample firms' earnings quality or financial disclosure

policies and their environmental disclosure policies. Also, firms with larger MVE may disclose less in their 10-Ks, and firms with higher Baginski and Whalen (2003) risk premia may disclose less in their 10-K reports.

Empirical Results Relating to Cost of Equity Capital/Risk Premium and Disclosure

H4 proposes that the estimated firm risk premium is associated with voluntary environmental disclosures. If this association is negative, it can be surmised that investors and analysts are influenced by the additional information to reduce their estimate of the riskiness of the firm's future cash flows. If the association is positive, these stakeholders find something in the information that implies greater risk. Table 9 presents the OLS regression results of equation (3). With the exception of the equation which employs *10KSoft* as the independent variable capturing disclosure, all of the regressions show a positive and significant coefficient on the disclosure variables. These results suggest that investors and analysts interpret greater disclosures in CERs as indicating greater firm risk. These results also suggest that these stakeholders interpret greater overall and hard disclosures in 10-Ks as indicating greater firm risk but do not find soft disclosures in 10-Ks credible or warranting such an interpretation. The results also show a consistently positive and highly significant relationship between shareholder resolutions regarding improved disclosure in 10-Ks and the estimated firm risk premium.

The results in Table 9 also show significant negative associations between estimated risk premium and the first environmental performance factor score when considered in conjunction with, or while controlling for, environmental disclosures in 10-K reports. These coefficient estimates are less significant or not significant when considered in conjunction with, or while controlling for, environmental disclosures in

CERs. None of the t-statistics for the second factor score is significant. At first, we found these results counter to what we had expected and puzzling. However, the t-statistics for the coefficient estimates for the variables capturing leverage in relation to MVE (*LevMVE*), long-term growth (*LTGrowth*), and information risk (*SDfeps*) are highly significant. It may be that investors and financial analysts consider these dimensions of financial performance to be much more important as risk indicators than environmental performance as captured by TRI and Trucost CO2e emissions.

Further analysis using an interaction term between the indicator variable for industry and each of our measures of disclosure is presented in Table 10. The results show significant differences for the relationship between voluntary disclosure and firm risk premium by industry. Our industry indicator variable is coded 1 for the electric utility industry and 0 for the chemical industry. The coefficients on the interaction terms are not significantly different from zero on any of the disclosure models, suggesting that there is no statistically significant association between environmental disclosure and firm risk premium in the electric utility industry. Chow F-tests show that the coefficients on disclosure for electric utilities are significantly different from the corresponding coefficients for the chemical companies in all CER models and in the total 10-K and hard 10-K disclosure model. Therefore, investors and analysts view the added risk from voluntary disclosures very differently between these two industries.

V. SUMMARY AND CONCLUSIONS

The results of this study, as well as its limitations, yield several interesting opportunities for further research. We find that there is a positive association between the level of environmental disclosure in 10-Ks and CERs and that the disclosure level

appears to be from a coordinated disclosure strategy. Analysis of press releases in addition to 10-Ks and CERs may provide an even fuller picture of the disclosure strategies of companies.

We also find that shareholder resolutions are positively associated with both disclosure and cost of equity capital. Lenox and Eesley (2009) document spillover effects within industries. The effects of shareholder resolutions targeting one particular company may be felt throughout its industry. With a larger sample of industries and a longer time series, this effect may be detected within the realm of environmental and social disclosure shareholder resolutions.

We find significant differences in the association between firm risk premium and disclosure for our two sample industries. This implies that analysts and shareholders view the costs and benefits of higher levels of disclosure differently depending on industry. This result, combined with disclosure differences between industries on nearly every category of 10-K and CER disclosure should provide empirical evidence in support of possible industry-by-industry approaches to mandated disclosures or integrated reporting. Finally, the positive association between voluntary environmental performance disclosure and risk premium is troubling. Bénabou and Tirole (2010) suggest that such "slow repricing" may occur because financial markets are learning how to evaluate the information presented. Certainly, it is difficult to conclusively determine whether information relating to environmental performance is "good news" or "bad news" in the conventional sense when the direct costs of improved performance can be high and the long-run benefits may be expected to occur well beyond two or three periods in the future.

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Exhibit 1
Variable Descriptions

CERDisc	total score from Clarkson et al. (2008) index measuring voluntary environmental disclosure in corporate environmental or sustainability reports,
CERHard	hard disclosures in corporate environmental or sustainability reports, Clarkson et al. (2008) A1–A4,
CERSoft	soft disclosures in corporate environmental or sustainability reports, Clarkson et al. (2008) A5–A7,
10KDisc	total score of items measuring environmental disclosure in10-K or annual reports,
10KHard	hard disclosures in 10-K or annual reports, D1-D6,
10KSoft	soft disclosures in 10-K or annual reports, D7,
BWpdiff	Baginski and Whalen (2003) measure of firm risk premium,
EMITfs	first factor score combining pounds of TRI emissions by emissions category, scaled by U.S. sales revenues ($million), and CO2e emissions, scaled by total sales revenues ($million),
EMITfs2	second factor score combining pounds of TRI emissions by emissions category, scaled by U.S. sales revenues ($million), and CO2e emissions, scaled by total sales revenues ($million),
SHResCER	number of shareholder resolutions requesting greater environmental disclosure in corporate environmental or sustainability reports,
SHRes10K	number of shareholder resolutions requesting greater environmental disclosure in corporate 10-K or annual reports,
LevAssets	ratio of total debt to total assets,
LevMVE	ratio of total debt to market value of common equity,
MktBook	market-to-book value of common equity,
MktBeta	market beta,
UBeta	unlevered beta,

Exhibit 1 (cont.)
Variable Descriptions

LTGrowth	expected long-term growth in earnings, as measured by the percentage change in analyst forecasts of earnings per share from period *t+2* to period *t+3* for firm *i* at the end of fiscal year *t*,
SDfeps	measure of information uncertainty or risk, as estimated by the standard deviation of analysts' forecasts of earnings per share,
AbnAccr	absolute value of estimated abnormal or discretionary accruals,
lnMVE	natural logarithm of market value of common equity,
ROA	income before extraordinary items divided by book value of total assets,
IndustDV	industry dummy variable equal to 1 if firm is an electric utility,

Table 1. Sample Descriptive Statistics

	All Sample	Chemical	Electric
Number of Firms	74	35	39
Number of Firm-year Observations	364	171	193
Proportion	100%	47.0%	53.0%
Mean Global Sales Revenues ($millions)	$7,849	$7,538	$8,124
Standard Deviation ($millions)	$7,327	$9,280	$5,010
Mean U.S. Sales Revenues ($millions)	$5,877	$3,654	$7,846
Standard Deviation ($millions)	$4,827	$3,476	$5,006
Mean Total Assets ($millions)	$14,631	$7,972	$20,531
Standard Deviation ($millions)	$13,429	$9,310	$13,775
Mean Return-on-assets	0.046	0.067	0.027
Mean Market Value of Common Equity ($millions)	$10,009	$10,182	$9,857
Mean Risk Premium	81.225	87.675	75.472
Standard Deviation	6.522	11.395	7.003
Mean Pounds TRI Emissions/US. Sales (per $1,000)	2.414	2.134	2.657
Standard Deviation (per $1,000)	2.980	2.957	2.985
Mean Tonnes Direct CO_2 Emissions/Total Sales (per $1,000)	3.103	0.531	5.332
Standard Deviation	3.572	0.626	3.574
Leverage (total debt/total assets)	0.326	0.274	0.372
Leverage (total debt/market value of equity)	0.717	0.414	0.981
Market Beta	0.940	1.119	0.785
Unlevered Beta	0.517	0.720	0.342
Abnormal Accruals (absolute value)	0.019	0.025	0.014
Standard Deviation	0.027	0.038	0.013

Notes: Descriptive statistics are based on firm-year observations for report release years 2005 through 2009.

Table 2. TRI and CO2e Scaled Emissions
Differences between Industry Mean Scores

	Chem	Electric	Diff	*t*-statistic
Number of firm-year observations	207	232		
Mean pounds of emissions per $1,000 U.S. sales:				
TRI air	1.002	1.799	-0.797	-4.04****
TRI land	0.132	0.691	-0.559	-9.50****
TRI water	0.112	0.006	0.106	7.45****
TRI underground injection	0.820	0.001	0.820	5.44****
TRI transfer offsite	0.128	0.161	-0.033	-1.43
TRI total emissions	2.194	2.657	-0.463	-1.63
Mean tons of CO2e emissions per $1,000 global sales	0.506	3.583	-4.775	-20.01****

Notes: Calendar years in which emissions take place range from 2003 to 2008 (2004-2008 emissions in disclosure equations; 2003, 2004, 2005, 2006, and 2008 emissions reported by EPA in May 2005 through December 2009 in cost of capital equations). Statistical tests reject equality of variances between industries. Therefore, approximate *t*-statistics and probabilities based on Cochran and Cox (1950) are reported; two-tailed tests; *pr>*t* <0.1; **pr>*t* <0.01; ***pr>*t* <0.001; ****pr>*t* <0.0001.

Table 3. Firm-year Observations with Environmental/Sustainability Reports

Year of Report Release	2005	2006	2007	2008	2009
Combined sample:					
Firm-year observations, total	69	73	74	74	74
Firm-year observations with reports	15	17	19	30	37
Percent observations with reports	21.74%	23.29%	25.68%	40.54%	50.00%
Chemical companies:					
Firm-year observations, total	30	34	35	36	36
Firm-year observations with reports	4	9	9	17	20
Percent observations with reports	13.33%	26.47%	25.71%	47.22%	55.56%
Electric utilities:					
Firm-year observations, total	39	39	39	38	38
Firm-year observations with reports	11	8	10	13	17
Percent observations with reports	28.21%	20.51%	25.64%	34.21%	44.74%

Notes: Environmental/sustainability reports are based on performance in 2004 through 2008.

Table 4. Clarkson et al. (2008) Environmental/Sustainability Disclosure Index Individual Item Descriptive Statistics

	Mean	SD
Hard disclosures		
(A1) Governance structure and management systems		
1. Existence of a Department for pollution control and/or management positions for env. management (0–1)	0.228	0.022
2. Existence of an environmental and/or a public issues committee in the board (0–1)	0.092	0.015
3. Existence of terms and conditions applicable to suppliers and/or customers regarding env. practices (0–1)	0.047	0.011
4. Stakeholder involvement in setting corporate environmental policies (0–1)	0.019	0.007
5. Implementation of ISO14001 at the plant and/or firm level (0–1)	0.089	0.015
6. Executive compensation is linked to environmental performance (0–1)	0.000	0.000
(A2) Credibility		
1. Adoption of GRI sustainability reporting guidelines or provision of a CERES report (0–1)	0.086	0.281
2. Independent verification/assurance about environmental information disclosed in the EP report/web (0–1)	0.008	0.091
3. Periodic independent verifications/audits on environmental performance and/or systems (0–1)	0.064	0.245
4. Certification of environmental programs by independent agencies (0–1)	0.000	0.000
5. Product Certification with respect to environmental impact (0–1)	0.003	0.053
6. External environmental performance awards and/or inclusion in a sustainability index (0–1)	0.181	0.385
7. Stakeholder involvement in the environmental disclosure process (0–1)	0.013	0.117
8. Participation in voluntary environmental initiatives endorsed by EPA or Department of Energy (0–1)	0.116	0.363
9. Participation in industry specific associations/initiatives to improve environmental practices (0–1)	0.112	0.328
10. Participation in other environmental organizations/assoc. to improve. environmental practices (0–1)	0.067	0.250
(A3) Environmental performance Indicators		
1. EPI on energy use and/or energy efficiency (0–6)	0.417	1.060
2. EPI on water use and/or water use efficiency (0–6)	0.439	1.410
3. EPI on green house gas emissions (0–6)	1.111	1.705
4. EPI on other air emissions (0–6)	0.833	1.539
5. EPI on TRI (land, water, air) (0–6)	0.547	1.218
6. EPI on other discharges, releases and/or spills (not TRI) (0–6)	0.303	0.914
7. EPI on waste generation and/or management (0–6)	0.678	1.340
8. EPI on land and resources use, biodiversity and conservation (0–6)	0.047	0.290
9. EPI on environmental impacts of products and services (0–6)	0.039	0.323
10. EPI on compliance performance (e.g., exceedances, reportable incidents) (0–6)	0.613	1.226
(A4) Environmental spending		
1. Summary of dollar savings arising from environment initiatives to the company (0-1)\	0.044	0.206
2. Amount spent on technologies, R& D and/or innovations to enhance environ. perf. and/or efficiency (0–1)	0.125	0.331
3. Amount spent on fines related to environmental issues (0–1)	0.139	0.346

Notes: SD = standard deviation; EPI = environmental performance indicators

Table 4. (cont.) Clarkson et al. (2008) Environmental/Sustainability Disclosure Index
Individual Item Descriptive Statistics

	Mean	SD
Soft Disclosures		
(A5) Vision and strategy		
1. CEO statement on environmental performance in letter to shareholders and/or stakeholders (0–1)	0.308	0.462
2. A statement of corporate environmental policy, values and principles, environ. codes of conduct (0–1)	0.186	0.389
3. A statement about formal management systems regarding environmental risk and performance (0–1)	0.111	0.315
4. A statement that the firm undertakes periodic reviews and evaluations of its environ. performance (0–1)	0.069	0.254
5. A statement of measurable goals in terms of future env. Performance (if not awarded under A3) (0–1)	0.058	0.234
6. A statement about specific environmental innovations and/or new technologies (0–1)	0.116	0.321
(A6) Environmental profile		
1. A statement about the firm's compliance (or lack thereof) with specific environmental standards (0–1)	0.061	0.239
2. An overview of environmental impact of the industry (0–1)	0.042	0.200
3. An overview of how the business operations and/or products and services impact the environment. (0–1)	0.133	0.340
4. An overview of corporate environmental performance relative to industry peers (0–1)	0.008	0.091
(A7) Environmental initiatives		
1. A substantive description of employee training in environmental management and operations (0–1)	0.416	0.002
2. Existence of response plans in case of environmental accidents (0–1)	0.050	0.218
3. Internal environmental awards (0–1)	0.041	0.214
4. Internal environmental audits (0–1)	0.131	0.345
5. Internal certification of environmental programs (0–1)	0.011	0.105
6. Community involvement and/or donations related to environ. (if not awarded under A1.4 or A2.7) (0–1)	0.228	0.420

Notes: SD = standard deviation

Table 5. Clarkson et al. (2008) Environmental/Sustainability Disclosure Index Statistics
Firm-year Observations with Environmental/Sustainability Reports

	Full Sample	Chem	Electric	Diff	*t*-stat
Number of firm-year observations	118	59	59		
Mean score:					
Clarkson A1	1.246	1.288	1.203	0.085	0.41
Clarkson A2	1.695	1.152	2.237	-1.085	-4.46****
Clarkson A3	12.703	12.983	12.424	0.559	0.38
Clarkson A4	0.780	0.610	0.949	-0.339	-2.50*
Clarkson A5	2.119	1.623	2.475	-0.712	-2.71**
Clarkson A6	0.568	0.136	1.000	-0.864	-6.09****
Clarkson A7	1.237	0.881	1.593	-0.712	-3.17**
Total disclosure score	20.347	18.814	21.881	-3.068	-1.40
Total hard disclosure score (A1-A4)	16.424	16.034	16.814	-0.780	-0.43
Total soft disclosure score (A5-A7)	3.924	2.780	5.068	-2.288	-4.29****

Notes: Environmental/sustainability reports released in 2005 through 2009, based on performance in 2004 through 2008. Statistical tests reject equality of variances between industries. Therefore, approximate *t*-statistics and probabilities based on Cochran and Cox (1950) are reported; two-tailed tests; *pr>*t* <0.1; **pr>*t* <0.01; ***pr>*t* <0.001; ****pr>*t* <0.0001.

Table 6. 10-K/Annual Report Environmental Disclosure Index Statistics
Percentages of Firm-year Observations Reporting Index Items

	Full Sample	Chemical	Electric
Number of firm-year observations	363	170	193
Percent reporting:			
D1. Litigation			
1. Litigation -- clean air	33.33	2.94	60.10
2. Litigation -- carbon dioxide	10.71	0.00	20.21
3. Litigation -- other	38.02	47.65	29.53
D2. Dollars spent on penalties and fines			
4. Dollars spent on penalties and fines	19.83	21.76	18.13
D3. Dollars spent on technologies, R&D, innovation			
5. Dollars spent on technologies, R&D, innovation	2.20	0.00	4.15
D4. Regulatory compliance and remediation costs			
6. Regulatory compliance costs	46.28	40.00	51.81
7. Remediation costs	39.91	45.29	35.23
D5. Compliance capital expenditures, reserves for remediation, and projected remediation costs			
8. Compliance capital expenditures	63.09	48.24	76.17
9. Reserves for remediation	68.60	79.41	59.07
10. Projected remediation costs	29.75	21.76	36.79
D6. Potentially responsible party			
11. Potentially responsible party (PRP) under CERCLA	66.12	57.65	73.58
D7. Management strategy and other issues			
12. Management strategy -- air	12.67	0.00	23.83
13. Management strategy -- greenhouse gases	28.10	24.12	31.61
14. Management strategy -- water	1.65	0.00	3.11
15. Management strategy -- ash and landfill	4.13	0.00	7.77
16. Other issues	7.71	14.12	2.07

Notes: 10-K and annual reports released in 2005 through 2009, based on environmental performance in fiscal years 2004 through 2008. 16. "Other issues" includes discussions regarding compliance with REACH and planned investments in wind and solar power generating facilities.

Table 7. 10-K/Annual Report Environmental Disclosure Index Statistics Differences between Industry Mean Scores

	Chem	Electric	Diff	*t*-stat
Number of firm-year observations	170	193		
Mean score:				
D1. Litigation	0.506	1.098	-0.593	-8.05****
D2. Dollars spent on penalties and fines	0.218	0.181	0.036	0.86
D3. Dollars spent on technologies, R&D, innovation	0.000	0.042	-0.042	-2.88**
D4. Regulatory compliance and remediation costs	0.853	0.871	-0.018	-0.21
D5. Compliance capital expenditures, reserves for remediation, and projected remediation costs	1.494	1.720	-0.226	-2.38*
D6. Potentially responsible party (PRP)	0.557	0.736	-0.159	-3.21**
D7. Management strategy and other issues	0.382	0.684	-0.302	-3.73***
Total disclosure score	4.035	5.332	-1.296	-5.08****
Total hard disclosure score (D1-D6)	3.647	4.648	-1.001	-4.60****
Total soft disclosure score (D7)	0.382	0.684	-0.302	-3.73***

Notes: 10-K and annual reports released in 2005 through 2009, based on performance in fiscal years 2004 through 2008. Statistical tests reject equality of variances between industries. Therefore, approximate *t*-statistics and probabilities based on Cochran and Cox (1950) are reported; two-tailed tests; *pr>*t* <0.1; **pr>*t* <0.01; ***pr>*t* <0.001; ****pr>*t* <0.0001.

Table 8. Disclosure Equations 2SLS Regression Results

Disclosure Measure	*CERDisc* (1)	*10KDisc* (2)
10KDisc	14.970 (3.91)****	
CERDisc		0.571 (4.48)****
EMITfs1	-8.991 (-2.36)**	0.915 (1.82)**
EMITfs2	-8.434 (-1.89)*	1.036 (1.62)*
SHResCER	23.465 (2.02)**	
SHRes10K		4.407 (3.71)****
AbnAccr		-1.235 (-0.12)
lnMVE	-5.533 (-1.45)	-1.660 (-1.95)**
ROA	129.595 (1.61)	-1.054 (-0.11)
BWpdiff	-0.160 (-0.81)	-0.007 (-1.83)*
IndustDV	-12.534 (-1.74)*	0.377 (0.78)
Intercept	-12.820 (-0.56)	14.302 (2.24)**
F-statistic	2.75	15.35
pr>F	0.0104	0.000

Notes: All regressions employ 328 firm-year observations and 74 firm clusters. Each cell contains coefficient estimate, with *z*-statistic in parentheses below; two-tailed tests; *pr>z <.1; **pr>z <.05; ***pr>z <.01; ****pr>z <.001. Variables defined in Exhibit 1.

Table 9. Risk Premium Equation Regression Results

Disclosure Measure	*CERDisc*	*10KDisc*	*CERHard*	*10KHard*	*CERSoft*	*10KSoft*
CERDisc	1.683 (3.30)****					
10KDisc		6.463 (2.05)***				
CERHard			1.951 (3.01)***			
10KHard				7.321 (2.10)***		
CERSoft					8.160 (3.87)****	
10KSoft						10.556 (1.24)
EMITfs1	-7.600 (-1.64)*	-12.112 (-2.50)***	-8.074 (-1.74)*	-12.395 (-2.54)**	-5.972 (-1.28)	-9.730 (-2.00)**
EMITfs2	-5.563 (-0.62)	-5.147 (-0.60)	-5.246 (-0.59)	-4.169 (-0.49)	-5.584 (-0.60)	-3.256 (-0.34)
SHRes10K	113.601 (13.50)****	98.473 (10.94)****	114.521 (13.42)****	103.79 (12.95)****	107.792 (12.78)****	97.105 (8.75)****
UBeta	-13.724 (-1.48)	-22.045 (-1.80)*	-13.656 (-1.48)	-22.415 (-1.77)*	-14.868 (-1.51)	-17.064 (-1.61)****
LevMVE	41.339 (2.71)***	41.327 (2.66)***	41.105 (2.67)***	41.149 (2.59)***	42.630 (2.85)***	42.307 (2.66)***
LTGrowth	-60.875 (-3.36)****	-66.785 (-3.66)****	-60.802 (-3.38)****	-64.917 (-3.66)****	-59.781 (-3.32)****	-62.573 (-3.47)***
SDfeps	114.778 (2.31)**	118.065 (2.44)***	115.078 (2.31)**	118.970 (2.47)***	115.551 (2.34)**	119.651 (2.33)**
lnMVE	5.341 (0.65)	7.212 (0.88)	5.292 (0.64)	6.998 (0.395)	6.784 (0.86)	9.737 (1.26)
IndustryDV	-0.0457 (-3.09)***	-33.894 (-1.87)*	-23.206 (-1.43)	-32.872 (-1.80)*	-31.723 (-1.99)**	-27.161 (-1.59)
Intercept	-10.904 -(0.15)	-34.316 (0.49)	-10.381 (-0.14)	-33.076 (-0.47)	-19.805 (-0.28)	-38.990 (-0.56)
R^2	0.1952	0.1835	0.1922	0.1823	0.2002	0.1743

Notes: All equations employ 350 firm-year observations and 74 firm clusters. Each cell contains coefficient estimate, with *t*-statistic in parentheses below; two-tailed tests; *pr>*t* <.1; **pr>*t* <.05; ***pr>*t* <.01; ****pr>*t* <.001. Variables defined in Exhibit 1.

Table 10. Risk Premium Equation Regression Results With Industry Disclosure Slope Interaction Terms

Disclosure Measure	*CERDisc*	*10KDisc*	*CERHard*	*10KHard*	*CERSoft*	*10KSoft*
CERDisc	1.901 (1.93)**					
CERDisc x IndustDV	-0.338 (-0.31)					
10KDisc		10.330 (2.22)***				
10KDisc x IndustDV		-7.346 (-1.30)				
CERHard			2.040 (1.75)*			
CERHard x IndustDV			-0.150 (-0.11)			
10KHard				10.729 (2.07)**		
10KHard x IndustDV				-7.520 (-1.20)		
CERSoft					15.371 (2.98)***	
CERSoft x IndustDV					-8.590 (-1.57)	
10KSoft						28.332 (1.46)
10KSoft x IndustDV						-22.781 (-1.08)
EMITfs1	-7.784 (-1.72)*	-13.684 (-2.74)***	-8.144 (-1.81)*	-13.667 (-2.66)***	-6.460 (-1.41)	-10.193 (-2.14)**
EMITfs2	-5.663 (-0.63)	-7.904 (-0.92)	-5.264 (-0.59)	-6.705 (-0.76)	-6.383 (-0.71)	-41643 (-0.49)
SHRes10K	113.475 (13.61)****	108.675 (9.73)****	114.417 (13.49)****	110.523 (11.75)****	108.807 (13.33)****	103.946 (8.74)****
UBeta	-13.367 (-1.41)	-25.125 (-1.91)*	-13.534 (-1.43)	-24.918 (-1.80)*	-13.060 (-1.31)	-18.038 (-1.82)*
LevMVE	40.689 (2.67)***	38.130 (2.46)***	40.863 (2.65)***	39.415 (2.49)***	40.204 (2.82)***	37.884 (2.39)**
LTGrowth	-61.509 (-3.40)***	-64.214 (-3.58)***	-60.996 (-3.40)***	-62.909 (-3.61)***	-64.440 (-3.39)***	-64.539 (-3.47)***
SDfeps	113.991 (2.24)**	115.809 (2.46)**	114.816 (2.26)**	117.301 (2.05)***	110.962 (2.19)**	0.0544 (2.33)**
lnMVE	5.060 (0.61)	5.670 (0.67)	5.192 (1.13)	6.356 (0.77)	5.960 (0.76)	7.404 (0.87)
IndustDV	-21.724 (-1.19)**	0.214 (0.01)	-22.048 (-1.20)	-1.843 (-0.07)	-19.472 (-1.15)**	-15.261 (-0.80)
Intercept	-9.798 (-0.14)	-31.836 (-0.45)	-9.975 (-0.14)	-36.530 (-0.53)	-19.287 (-0.28)	-21.913 (-0.29)
Chow F-test	5.75	2.72	4.90	2.34	9.69	1.31
pr>F	0.0048	0.0726	0.0101	0.1036	0.0002	0.2766
R^2	0.1955	0.1877	0.1923	0.1854	0.2049	0.1776

Notes: All equations employ 350 firm-year observations and 74 firm clusters. Each cell contains coefficient estimate, with *t*-statistic in parentheses below; two-tailed tests; *pr>*t* <.1; **pr>*t* <.05; ***pr>*t* <.01; ****pr>*t* <.001. Degrees of freedom for all Chow F-tests (2,73). Variables defined in Exhibit 1.